Pantala flavescens, Fabr.

1 ♂ (203), Baie Ngo, 10. ii. 14 ; 1 ♂ (249), 1 ♀ (248), Plaine des Lacs, 17. ii. 14 ; 3 ♂ (349, 350, 352), 1 ♀ (351), Plaine des Lacs, 25. ii. 14 ; 1 ♂, Mt. Nekando, 25. v. 14 ; 2 ♀, Canala, 23. vi. 14.

2 nymphs, Mt. Canala, 12. vi. 14.

EXPLANATION OF THE PLATES.

Wing-photographs by F. W. Campion.

PLATE VIII.

Fig. 12. *Synthemis miranda*, Selys, ♂, allotype.
Fig. 13. *Synthemis montaguei*, sp. n., ♂, holotype.
Fig. 14. *Synthemis flexicauda*, sp. n., ♂, holotype.

PLATE IX.

Fig. 15. *Synthemis flexicauda*, sp. n., ♀, allotype.
Fig. 16. *Synthemis fenella*, sp. n., ♂, holotype.
Fig. 17. *Metaphya elongata*, sp. n., ♀, holotype.

III.—*The Old-World Species of* Eriocera *in the British Museum Collection* (*Diptera*, Tipulidæ). By F. W. EDWARDS.

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[Plate X. figs. 1–12.]

THE genus *Eriocera* * has long been familiar to students of Nematocerous Diptera, many representatives having been met with and described by the early workers on the order—Wiedemann, Macquart, and Walker ; these were discussed and their number added to by Osten-Sacken ; more recently a considerable number of species have been described by Alexander, Brunetti, Enderlein, and de Meijere, so that at the present time the number of known species is very considerable. Having regard to this fact, and also to the conspicuous and varied ornamentation of many of the species, it is not surprising that attempts have been made to dismember the genus. The first of these (apart from generic

* With a strict application of the rule of priority, the name *Caloptera*, Guérin, should be used for this genus, since it was published with a recognizable figure (though without verbal description) eight years before *Eriocera*.

names proposed independently by earlier authors) was that of Osten-Sacken, who proposed the name *Arrhenica* for a species with long antennæ in the male sex, and also maintained as distinct Schiner's genus *Penthoptera*. For the latter proceeding I can see no justification whatever; the minute characters which Osten-Sacken depended upon seem to me to be entirely trivial.

A further attempt at division was that of Enderlein (1912), who recognized four groups—*Arrhenica* and *Androclosma* with long antennæ in the male, *Physecrania* and *Eriocera* with short male antennæ; *Arrhenica* and *Physecrania* with five posterior cells, the other two with only four. Brunetti and Alexander have both maintained that these divisions were unnatural and untenable, and after a careful study of the material in the British Museum, I am bound to accept their view. In particular, the length of the male antennæ proves to be totally unreliable as an indication of relationship. This is admirably shown by the three species, *E. verticalis*, *E. fusca*, and *E. yerburyi*. In the first the male antennæ are almost three times as long as the body, while in the second they are like those of the female, not longer than the thorax. The two species, however, resemble one another rather closely in their general black coloration, the venation is very similar, and, most important of all, the male hypopygia are barely distinguishable. If further confirmation were needed of the close relationship of these two species, it is provided by *E. yerburyi*, which differs from *E. verticalis* chiefly in the male antennæ being only about as long as the body. On the other hand, Enderlein associated with *E. verticalis* in the genus *Androclosma* his *A. ornatum*, which likewise has greatly elongated antennæ in the male sex. This species, however, is so very distinctive in its wing-markings, its venation, and its hypopygial structure that it obviously has only remote connection with *E. verticalis* and *E. fusca*. The third species of Enderlein's, *Androclosma* (*E. lunata*, Westw.), also occupies a rather isolated position, and does not show any very marked relationship either to *E. ornata* or *E. verticalis*, apart from the form of the male antennæ.

Whatever may be the biological significance of the elongation of the male antennæ, it is interesting to note that the same phenomenon occurs in an equal degree in the Tipuline genus *Macromastix*, and that in both these genera the elongation is accompanied by a great enlargement of the basal joint and of the frontal tubercle—perhaps for the accommodation of larger muscles necessary for moving the heavier

antennæ. Another feature seen in most, if not all, species of *Eriocera* and *Macromastix* with elongate male antennæ is the reduction in the length of the abdomen in that sex.

Turning to the other point on which Enderlein based his generic distinctions, the number of posterior cells (presence or absence of cell M_1), here again it is doubtful if the distinction has any phylogenetic value. Among those with cell M_1, as among those without it, there are a number of species-groups which, if the genus were divided, might be made into subgenera, but a study of the details of venation and male hypopygium suggests that some of those without cell M_1 may be more nearly related to those possessing it than to others which do not. Moreover, those possessing the cell are certainly not all closely related among themselves.

Rather than subdivide the genus into a number of natural but small and poorly definable groups, I consider it will be preferable to enlarge it by including the genus *Penthoptera*, and also two species from the Seychelles which I referred in 1912 to *Anisomera*. One of these species shows a remarkable variation in venation which I overlooked at the time of description, and they both differ markedly from the typical species of *Hexatoma* (*Anisomera*) in having a well-developed ovipositor. Further, it is quite obvious that they are closely related to the two species of *Eriocera* described from the same islands. On the other hand, I consider that the two species with a short fleshy ovipositor (the African *E. pusilla*, Alex., and the N. American *E. longicornis*, Walker) would be at least equally well placed in *Hexatoma*.

The tendency to the development of local forms is strongly marked throughout the genus, and there are very few species which have a wide distribution. This may be accounted for by the breeding-habits of the species, most of which probably spend their early stages in the ground at the edges of rapid streams, and probably do not migrate much from one valley to another.

In the following table of species, all those at present known from the Palæarctic, Oriental, Australasian, and Ethiopian regions are included, only American forms being omitted. So far as possible, the diagnostic characters have been arranged to give what appears to be a natural arrangement of the species, but there are a considerable number which I have not seen, and whose proper position is therefore more or less a matter of conjecture. Nevertheless, there are no fewer than sixty species in the National Collection from the regions under consideration, and it is

probable that these represent most, if not all, of the main groups of the genus, although more than a score of them are unfortunately represented by females only.

I wish to express my thanks and indebtedness to my friends Dr. C. P. Alexander, Mr. E. Brunetti, and Herr M. P. Riedel for the loan or presentation of several types and other specimens.

Key to Old-World Species of Eriocera (sens. lat.).

(Those marked * have not been seen by the author.)

1.	Rs at least twice as long as R; R_3 upturned and ending well before the tip of the wing; Cu_1 widely divergent from M_3, and forming an angle with the lower margin of the discal cell; wings elaborately streaked with dark. (Sumatra, Borneo.)	*ornata* (End.).
	Rs less than twice as long as R, usually much less (but compare *obscuripennis*, Edw.); R_3 not upturned at tip and ending close to the tip of the wing; Cu_1 parallel with M_3, and almost in a straight line with the lower margin of the discal cell; wings not conspicuously streaked with dark	2.
2.	Cross-vein *r* placed about the middle of R_{2+3}, which is much longer than R_2. (Seychelles.)	*luteipennis* (Edw.).
	Cross-vein *r* placed much beyond the middle of R_{2+3}, usually beyond it on R_2	3.
3.	Sc ending opposite or before the apex of Rs; Ax straight, or convex towards An.	4.
	Sc ending at least slightly beyond the apex of Rs; Ax longer and more or less concave towards An	10.
4.	R_{2+3} almost as long as, or even longer than, R_2; wing-membrane brownish with dense microtrichia (normal); Ax noticeably convex towards An; small reddish species. (Seychelles.)	5.
	R_{2+3} much shorter than R_2; wing-membrane hyaline, the microtrichia abnormally sparse; Ax practically straight. (Ceylon.)	7.
5.	Wing-membrane towards tip with distinct macrotrichia	*obscuripennis*, Edw.
	Wing-membrane without macrotrichia.	6.
6.	Wings with pale streaks in the cells; four posterior cells	*fuscinervis*, Edw.
	Wing uniformly brownish; three posterior cells	*ferruginea* (Edw.).

7.	Black species ; wings perfectly hyaline .	*crystalloptera*, O.-S.
	At least partly orange, or wings with dark bands	8.
8.	Wings with dark bands; abdomen and sometimes the thorax black.....	*humberti*, O.-S.
	Wings without dark bands.....	9.
9.	Thorax orange with black stripes, abdomen black	*meleagris*, O.-S.
	Thorax entirely, abdomen mainly orange.	**pachyrrhina*, O.-S.
10.	Upper basal cell at its apex quite twice as broad as the lower; wings with conspicuous markings; Rs parallel with R_1 near the base. (Borneo.)	*lunata*, Westw.
	Upper basal cell little if any broader than the lower; Rs not parallel with R_1 near the base	11.
11.	R_2 much shorter than R_{2+3}; tip of R_1 upturned and slightly shorter than r; small black species; male antennæ elongate; anal cerci of female short and fleshy. (Tropical Africa.)	*pusilla*, Alex.
	R_2 at least as long as R_{2+3}; tip of R_1 straight, or at most slightly upturned, as long as or longer than r; anal cerci of female long and horny.....	12.
12.	R_2 little if any longer than R_{2+3}; r at or close to base of R_2; Cu_1a near base of discal cell; four posterior cells; uniformly blackish or brown species; wings without markings other than the stigma	13.
	R_2 longer than R_{2+3} (nearly always much longer, but compare *E. ctenophoroides*); r generally well beyond base of R_2; Cu_1a generally well beyond base of discal cell	25.
13.	Rather light brown species; the thorax with darker stripes; wings practically clear. (Australia.)	14.
	Darker brown to black species; wings more or less infuscated.....	15.
14.	Discal cell closed	*australiensis*, Alex.
	Discal cell open.....	*aperta*, Alex.
15.	Whole body deep black, not at all shining. (India.)	**aterrima*, Brun.
	Not wholly black, or, if so, then partly shining	16.
16.	Male antennæ twice as long as the body; unicolorous black. (Amboina.).....	**atra*, Dol.
	Male antennæ more or less than twice as long as the body	17.
17.	Head yellowish, at least on the frontal tubercle; male antennæ more or less elongate	18.
	Head entirely dark; antennæ alike in the two sexes.....	21.

18. Thorax and abdomen almost wholly shining black. (Tropical Africa.) .... *nyasicola*, Alex.
Thorax scarcely or not shining, both it and the abdomen black ..... 19.
19. Male antennæ a little shorter than the body; cross-vein *r* at base of R_2. (Ceylon.) ..... *yerburyi*, sp. n.
Male antennæ three times as long as the body; cross-vein *r* a little beyond base of R_2 ..... 20.
20. Cu_1a a little beyond base of discal cell. (Oriental region.) ..... *verticalis*, Wied. (= *morio-kana*, Mats.).
Cu_1a exactly at base of discal cell. (Africa.) ..... *tumidiscapa*, Alex.
21. Abdomen shining black ..... 22.
Abdomen dull ..... 23.
22. Wings yellowish at the base. (S. Europe.) **cimicoides* (Scop.).
Wings entirely blackish. (Formosa.) .. *nigrina*, Riedel.
23. Thorax grey with four strongly shining black stripes. (Hungary.) ..... **grisea* (Riedel).
Thorax blackish brown with three moderately shining black stripes ..... 24.
24. Stigma absent; legs with strong bluish-metallic reflections. (Ceylon.) ..... *fusca*, Edw.
Stigma distinct; legs with faint bluish reflections. (Japan.) ..... *nipponensis*, Alex.
25. Wings with a conspicuous dark blotch at base of Rs, and other dark markings on a pale ground ..... 26.
Wings with a blackish ground-colour, with or without pale markings, or lighter with a stigma only ..... 27.
26. Costal cell dark; head and thorax shining blue-black. (India.) ..... *tripunctipennis*, Brun.
Costal cell yellowish; head and thorax dull greyish. (Japan.) ..... *longifurca*, Alex.
27. Wings moderately infuscated, without pale markings; stigma present, though sometimes faint; cross-vein *r* about its own length distant from tip of R_1 .... 28.
Wings darker, often with distinct markings; stigma absent; cross-vein *r* more than its own length distant from tip of R_1 (usually much more) ..... 34.
28. Very large species; thorax densely hairy; frontal tubercle well developed. (Japan.) *stricklandi*. sp. n.
Medium-sized or small species; thorax practically bare; frontal tubercle feebly developed ..... 29.
29. Four posterior cells; sides of mesonotum with velvet-black spots ..... 30.
Five posterior cells; sides of mesonotum without velvet-black spots ..... 31.
30. Thorax black. (India.) ..... *rufiventris*, Brun.
Thorax mainly reddish. (Sumatra.) .. *pœnulata*, End.
31. Cell M_1 more than twice as long as its petiole; discal cell not much longer

than broad; whole body orange. (Himalayas.) ..... *aurantia*, Brun.
Cell M_1 about as long as its petiole; discal cell rather elongate; wings narrower in proportion ..... 32.
32. *r–m* cross-vein twice its length beyond fork of Rs; head black above. (Borneo.) *rubrescens* (Walk.).
r–m cross-vein close to fork of Rs; head lighter ..... 33.
33. Thorax uniformly orange. (Borneo.) .. *pyrrhochroma* (Walk.).
Thorax brownish yellow, with three light reddish-brown stripes. (Sumatra.) .. **angustipennis* (End.).
34. Wings without distinct markings ..... 35.
Wings with distinct white or yellowish markings at the tip, or in the middle, or in both places (markings faint in *robinsoni*) ..... 57.
35. Abdomen without distinct shining bands. 36.
Abdomen black, with alternating shining and velvety bands ..... 55.
36. Metatarsi white. (S. Europe.) ..... **chirothecata* (Scop.).
Metatarsi not white (unknown in *waterstoni*) ..... 37.
37. Abdomen entirely black; five posterior cells ..... 37 *a*.
Abdomen at least partly orange ..... 40.
37 *a*. Head and base of antennæ orange. (Madagascar.) ..... **obscura*, Big.
Head and antennæ dark ..... 38.
38. Thorax grey, with three shining black stripes; wings light brown. (Corsica.) *schnusei* (Kuntze).
Thorax black; wings blackish ..... 39.
39. Thorax dull; abdomen somewhat shining. (Macedonia.) ..... *waterstoni*, sp. n.
Thorax shining; abdomen dull ..... **unicolor*, Meij.
40. Wings darkest along costa and on apical third; five posterior cells ..... 41.
Wings uniformly dark (rarely yellow at the base) ..... 42.
41. Abdominal segments 1–3 [or 2–4?] orange. (Java; Formosa.) ..... **nigripennis*, Meij.
Abdominal segments 2–5 orange, with narrow blackish hind borders. (India.) *semilimpida*, Brun. [(=*maculiventris*, Brun.).
42. Abdomen with segments 1–4 or 2–5 entirely yellow or orange; 5–8 or 6–8 entirely blackish; five posterior cells (except in *shirakii*) ..... 43.
Abdomen otherwise coloured; four posterior cells ..... 48.
43. Thorax mainly or wholly red ..... 44.
Thorax black ..... 45.
44. Thorax with dark stripes; femora yellow except at tip; six distinct flagellar joints in female ..... **ferruginosa*, Wulp.
Thorax unstriped; femora black except at base; ten distinct flagellar joints in female ..... **nigroapicalis*, Brun.

45. Flagellum of antennæ and base of wing yellow. (Borneo.) ..... *dichroa*, Walk.
Flagellum black; wings entirely blackish. 46.
46. Abdominal segments 1–4 orange; length 20 mm. (Penang.) ..... *umbripennis*, sp. n.
Abdominal segments 2–5 orange ..... 47.
47. Five posterior cells; length 8 mm.; male antennæ as long as thorax. (Java.) ..... **xanthopyga*, Meij.
Four posterior cells; length 14 mm.; male antennæ longer than the thorax. (Formosa.) ..... *shirakii*, sp. n.
48. Thorax extraordinarily humped; front half of præscutum yellowish; the remainder of the thorax dark brown; abdomen almost entirely ochreous-orange. (Ceylon.) ..... *tuberculifera*, Edw.
Thorax not more humped than usual; both it and the abdomen quite differently coloured ..... 49.
49. Cu$_1$a at base of discal cell. (Sumatra.) . **simalurensis*, Meij.
Cu$_1$a well beyond base of discal cell .... 50.
50. Head and thorax wholly blackish ..... 51.
Head and thorax partly orange or reddish. 53.
51. Wings yellowish at the base; abdominal segments 1–6 with black apical triangles. (India.) ..... *triangularis*, Brun.
Wings not yellowish at the base; abdominal tergites without black apical triangles ..... 52.
52. Abdomen black; third and fourth segments mainly yellowish. (India.) .... **caliginosa*, Brun.
Abdomen mainly brownish. (India.) .. **testacea*, Brun.
53. Thorax shining. (Sierra Leone.) ..... *leonensis*, Alex.
Thorax dull ..... 54.
54. Præscutum black. (Formosa.) ..... *rubriceps*, Edw.
Præscutum orange, with three black stripes. (Ceylon.) ..... *scutellata*, Edw.
55. Thorax wholly red. (Singapore.) ..... *plecioides* (Walk.).
Thorax wholly black ..... 56.
56. Four posterior cells (the number is not stated in the description, but must be four, since Osten-Sacken refers to the bases of the second and third being nearly in a line). (Celebes.) ..... **morosa*, O.-S.
Five posterior cells ..... *lygropis*, Alex.
57. Wing-markings at the tip only; four posterior cells ..... 58.
Wings with distinct median pale markings ..... 70.
58. A single white spot at the extreme tip of the wing ..... 59.
Three white spots round the wing-tip (one large, two small). (Ceylon.) .... 65.
59. Costal region broadly orange, except towards base and apex. (India.) ..... *flavicosta*, sp. n.
Costal region all dark ..... 60.

60.	Abdomen and thorax chestnut-brown, 5th and 6th segments largely yellow. (India.)	**elongatissima*, Brun.
	Abomen otherwise	61.
61.	Thorax entirely velvet-black	62.
	Thorax not entirely black	64.
62.	Femora yellow with black tips; abdominal segments 2–5 nearly all yellow; 6 yellow at base. (Java.)	*albipunctata*, Wulp.
	Legs all black; abdominal segments 2–5 with broad apicalblack bands. (S. India.)	63.
63.	Sixth abdominal segment entirely black	*kempi*, Brun.
	Sixth abdominal segment yellow at the base	*kempi*, var. n. *longior*.
64.	Thorax mahogany-brown; præscutum with three blackish stripes. (India.)	**tenuis*, Brun.
	Thorax ash-grey, præscutum with four black stripes. (India.)	**pulchrithorax*, Brun.
65.	Abdomen velvet-black, with broad shining blue-black bands; legs black, stout.	66.
	Abdomen not all black, mainly dull; femora mostly yellowish; legs more slender	67.
66.	Thorax entirely red; legs very stout	*ctenophoroides*, Edw. [(=*rufithorax*, Brun.).
	Thorax entirely blackish brown; legs not quite so stout	[*nigrithorax*. *ctenophoroides*, var. n.
67.	Basal halves of abdominal segments 2–4 shining; thorax brown	*badia*, Brun.
	Abdominal segments 2–4 entirely dull, or uniformly and slightly shining	68.
68.	Abdomen entirely brownish; slightly shining	*greenii*, Brun.
	Abdomen dull, basal segments yellow	69.
69.	Thorax and apex of abdomen velvet-black; femora with black tips	*albonotata*, Lw.
	Thorax and apex of abdomen brownish; femora all yellow	[*citrocastanea*. *albonotata*, var. n.
70.	Wings with a transverse pale central fascia or spot; apical fourth all dark	71.
	Wings with pale central markings, and also with pale markings at the tip or in the apical fourth	88.
71.	Abdomen with leaden or bluish-white bands; four posterior cells	72.
	Abdomen without leaden or bluish-white bands	80.
72.	Wing-markings faint; body wholly blackish. (Siam.)	*robinsoni*, sp. n.
	Wing-markings conspicuous	73.
73.	Several distinct white spots about the middle of the wing, in addition to the fascia. (Himalayas.)	**decorata*, Brun.
	Wings with a whitish central fascia only.	74.
74.	Base of wing conspicuously yellow, often also the costa to a large extent	75.
	Base of wing not yellow	78.

75. Cross-vein *r* vertical, far beyond base of R_2. (Sumatra.) ..... **sumatrensis*, Macq.
Cross-vein *r* very oblique, close to or even before base of R_2..... 76.
76. Flagellum and legs yellow; head dark brown; frontal tubercle simple; central fascia reaching hind margin. (Assam.) *assamensis*, sp. n.
Flagellum and legs dark; head velvet-black; frontal tubercle divided; central fascia rarely reaching hind margin.... 77.
77. Male abdomen with segments 3–5 elongate, shining black at the base, pale bluish grey in the middle, velvety-black at the tip. (India.) ..... [(=*velutina*, Walk.). *nepalensis*, Westw.
Male abdomen with segments 3–5 much shorter, without bluish-grey bands in the middle. (W. China.) ..... *sinensis*, sp. n.
78. Dorsum of thorax orange. (Tonkin, Assam.) ..... **fenestrata*, Brun.
Thorax black or dark grey ..... 79.
79. Thorax grey with black stripes, legs mainly yellow. (India.) ..... *flavipes*, Brun.
Thorax entirely black, somewhat shining; legs blackish. (Hong Kong; Japan.) [*guttata*, Mats.). *hilpa*, Walk. (=*albo-*
80. Abdomen entirely dull black; four posterior cells. (India.) ..... **nigerrima*, Brun.
Abdomen not entirely dull black ..... 81.
81. Four posterior cells; apex of abdomen shining. (Philippines.) ..... 82.
Five posterior cells ..... 83.
82. Hind legs normal; abdomen dilated, with yellowish bands near base ..... **lativentris*, Bezzi.
Hind legs thickened; abdomen not dilated, entirely black ..... **crassipes*, Bezzi.
83. Thorax reddish; legs mainly yellow. (Java.) ..... *mesopyrrha*, Wied.
Thorax black or blackish brown..... 84.
84. Femora and tibiæ yellow with black tips. (Philippines.)..... *perennis*, O.-S.
Legs black ..... 85.
85. Wings yellow at base ..... 86.
Wings dark at base..... ..... 87.
86. Second, third, and ninth abdominal segments orange, rest black. (Sumatra.) . *bicolor*, Mcq.
Abdominal segments 2–5 orange with broad black hind margins. (Java.) .. **cingulata*, Meij.
87. Abdomen orange on basal half; central fascia reaching hind margin. (Sumatra.) *pyrrhomesa*, Edw.
Abdomen with one or two yellow cross-bands near base; central fascia not reaching hind margin. (Philippines.) . **mansueta*, O.-S.
88. Five posterior cells; abdomen with grey bands; wings with white spot at the tip, central spot divided ..... 89.
Four posterior cells ..... 95.
89. Basal half of wing entirely yellow. (Hong Kong.) ..... *chrysomela*, sp. n.

Basal half of wing not entirely yellow; two white spots in the middle	90.
90. Costal border yellow; femora yellow with black tips.....	91.
Costal border dark.....	92.
91. Thorax with short pubescence; grey bands of abdomen over black ground-colour. (Himalayas.).....	*plumbicincta*, Brun.
Thorax with long pubescence; grey bands of abdomen over yellow ground-colour. (Assam.)	*plumbolutea*, sp. n.
92. Thorax black, except for the yellowish scutellum	*trimaculata*, sp. n.
Front of mesonotum red	93.
93. Femora yellow with black tips. (Himalayas.)	[Brun., nec Meij.). **cincta*, Brun. (*cingulata*,
Legs black	94.
94. Scutellum and postnotum blackish. (Himalayas.)	*gravelyi*, Brun.
Scutellum and postnotum orange. (Assam.)	*brunettii*, sp. n.
95. Black species; wing-markings all yellowish; a pale spot near base of inner marginal cell, which does not spread out into the upper basal	96.
Not with all the above characters	97.
96. A small yellowish spot at wing-tip; membrane partly iridescent. (Sumatra.)	**gamma*, End.
Wing-tip dark; membrane not iridescent. (Formosa.)	*sauteriana*, End.
97. Apical wing-marking just before the tip.	98.
Apical wing-marking at the extreme tip.	101.
98. Wings with additional white markings more basal than the central fascia ..	99.
Wings with only the central fascia and a more or less oval spot near the tip white.	100.
99. Thorax black; base of wing yellow. (Java.)	*basilaris*, Wied.
Thorax yellowish brown to dark brown; base of wing dark. (Sumatra.)	**pannosa*, End.
100. Wing-base and costal cell yellow; halteres yellow. (Borneo.)	*infixa* (Walk.).
Wing-base dark; halteres black. (Borneo.)	*borneana*, sp. n.
101. Several white spots round wing-tip....	102.
A single white or yellow spot at wing-tip.	103.
102. Thorax black; wings darker anteriorly. (Tenasserim.)	**rufibasis*, Brun.
Thorax reddish brown; costal cell yellowish. (Borneo.).....	[(=*diluta*, Walk.). *combinata* (Walk.)
103. Thorax with three brightly shining stripes. (Borneo, Java.)	[(=*optabilis*, Walk.). *lunigera* (Walk.)
Thorax entirely dull	104.
104. Abdomen black, the tergites shining basally.....	105.
Abdomen partly orange, dull	106.
105. Cu$_1$a at tip of discal cell; thorax red. (Sumatra.)	**selene*, O.-S.

	Cu$_1$a before tip of discal cell; thorax dark reddish brown. (Borneo.)	*leucotela* (Walk.).
106.	Abdomen with a median blackish-brown longitudinal stripe. (Java; Bengal.)	*acrostacta*, Wied.
	Abdomen without such stripe	107.
107.	Thorax and last two abdominal segments black, rest reddish. (Java.)	**javensis*, Dol.
	Thorax reddish brown	108.
108.	Femora and tibiæ all yellowish. (Bengal.)	**diana*, Macq.
	Femora and tibiæ with black tips. (Sumatra.)	*klossi*, Edw.

The Hypopygial Structure.

The hypopygium of *Eriocera*, which is in general similar to that of many Limnophilinæ, shows a number of interesting features. For the most part the terms employed in the descriptions are those used by me for the Culicidæ (see 'Annals of Tropical Medicine and Parasitology,' xiv. 1920, pp. 23–40). There are, however, important differences between the two families, and in some respects it is difficult to homologise the parts, so that a full description of the general type of structure in *Eriocera* will be useful to make clear the descriptions and figures. It is necessary to state first that in *Eriocera* there is no torsion of the ninth and tenth abdominal segments.

The *ninth tergite* is well developed and usually of quite simple structure, sometimes produced or emarginate in the middle, but never with conspicuous developments. It is impossible to detect any line of division between the ninth tergite and ninth sternite—in fact, the tergite may perhaps be regarded as forming a complete ring, and the sternite as absent altogether. That this may be the true state of affairs is shown by the traces of a suture in the mid-ventral line which can sometimes be detected. This is the normal condition in the Limnophilinæ, but it may be noted that in one or two Limnophiline genera (e. g., *Phyllolabis*) a small separate ninth sternal piece is present, which may or may not represent the true ninth sternite in an obsolescent condition.

The *side-pieces* are well developed, tubular, usually simple, but occasionally with basal lobes. There are two pairs of *claspers* (*outer* and *inner*), which in many cases are incompletely separated, indicating clearly that the inner pair has arisen as a development from the base of the outer (or *vice versa*). The outer clasper is strongly chitinised, more or less bare, with a sharp-pointed, often hooked tip, but without terminal spine. The inner clasper is fleshy, hairy, and has

on its outer surface a groove into which the outer clasper fits. The two pairs articulate together at the tip of the side-piece, and are movable in a horizontal plane.

The *tenth* (*anal*) *segment*, as in most Limnobiidæ, is a spicular tube of tough membrane, usually entirely devoid of chitinisation and retracted beneath the ninth tergite. Very rarely a pair of small tergites bearing a few bristles are present. I have seen no indications of cerci, though in some Limnophilinæ these are represented by terminal papillæ.

The *ædœagus* (see text-fig. 2, h) is highly chitinised and complicated, and is probably in a much more generalised condition than that of the Culicidæ. In the main, the general conception of the genital tube given by Sharp and Muir for the Coleoptera (Trans. Ent. Soc. London, 1912, p. 602, fig. 239) will fit that of *Eriocera* very well. The main differences lie, firstly, in the fact that in *Eriocera* the mesosome (median lobe) is permanently invaginated, and, secondly, that there is a strong chitinisation of part of the "first connecting membrane" between the mesosomal and tegminal rings of the genital tube.

On the dorsal side of the ædœagus, continuous, on the one hand, with the second connecting membrane (at the base of the tenth segment) and, on the other hand, with the tubular penis, is a large chitinous structure, whose homologies are somewhat uncertain. It might be possible to regard it, or part of it, as the tenth sternite, and its appendages as anal cerci, but from the fact that it never bears any bristles, also because it is in contact or fused laterally with the basal plates, I think it must certainly be regarded as part of the tegminal ring of the genital tube. This is also indicated by its readiness to take up stain, quite unlike the chitinisations of the body-wall, but agreeing in this respect with the rest of the genital tube. It bears a pair of processes (*parameres*), which in their free portion are very variously constructed ; at the base these processes spread out, and are fused laterally with processes from the base of the side-pieces and medially with one another. The median fused portion forms a strong bar connecting the bases of the side-pieces, and extends almost vertically downwards to the base of the penis ; in the dorsal portion of this median structure there are distinct traces of fusion, but none at all in the ventral portion. The pair of processes are undoubtedly homologous with the gonapophyses of de Meijere and others, which I have elsewhere identified with the parameres ; this identification is possibly incorrect, since in the Culicidæ the parameres are articulated

definitely with the basal plates, and are ventral rather than dorsal to the mesosome. However, if we regard both organs as belonging to the tegminal ring of the genital tube (which seems most probable) there can be no great obligation to using the same name in each case. A name is required for the unpaired median portion. It cannot be called the tegmen, since this term has been used by Sharp and Muir for "the lateral lobes [parameres] and basal piece together," while in the present case the basal plates are distinct structures. I propose the term *dorsal plate*, in default of a better; it seems to be the analogue of the ventral plate described by Sharp and Muir in the Scarabæidæ, which is also fused with the parameres, and morphologically on the dorsal side of the tube.

The *basal plates* are well developed, and obviously homologous with those of the Culicidæ. They are usually in the form of two distinct latero-ventral plates, but are sometimes connected in the mid-ventral line by a narrow bridge of chitin; in one species (*E. semilimpida*) this bridge is quite broad. From this condition it is easy to imagine a transition to a state in which the basal plate forms an unpaired ventral piece. In the species mentioned the connecting bridge is external, the mid-ventral portion of the second connecting membrane not being invaginated.

Distal to the dorsal and basal plates, and connected with them by a short straight membrane, is a complete ring of chitin, generally tubular in form, but varying greatly in length in the different species. Although it is possibly the homologue of the mesosome of the Culicidæ, it is certainly not the same as the median lobe of Sharp and Muir, since the membrane connecting it with the dorsal and basal plates is very short and not at all invaginated; it may best be regarded rather as a distal tubular portion of the tegminal ring, such as has been noted by Sharp and Muir in certain Coleoptera. It is the organ called the penis by de Meijere and others, and, though this term is not free from objection, I propose to retain it provisionally; Snodgrass's term "penis-guard" would be equally appropriate.

At the tip of the penis is a small circular opening, from which the genital tube is continued backwards as a thin-walled tube (lying within the penis) as far as the base of the penis, or a little farther; it then enlarges again into a chitinous body, which is provided with a conspicuous apodeme extending towards the interior of the body. At the base of this apodeme is a hole in the sac, which probably marks the point at which the membranous portion of the

genital tube (*stenazygos*) enters the chitinised sac. The apodeme seems to be analogous to, though it may not correspond morphologically with, the median strut of Sharp and Muir. It is most developed in those species with a short penis. It seems probable that this chitinised sac corresponds rather with the median lobe than with the internal sac of the Coleoptera. In that case, the slender tube connecting the sac with the tip of the penis must be regarded as the permanently invaginated distal portion of the first connecting membrane, and the penis itself as a special chitinisation of the proximal portion of this same "membrane."

Descriptions of new Species and Varieties.

1. *Eriocera yerburyi*, sp. n., ♂.

Head ochreous, the proboscis, scape of antennæ, and basal joint of palpi of the same colour; rest of palpi, and flagellum of antennæ except base of first joint, blackish. Frontal tubercle very large, simple. First scapal joint considerably swollen, about twice as long as broad. Flagellum four-jointed, a little more than twice as long as the thorax; numerous bristly hairs on the underside. Fourth joint of palpi about as long as the two preceding together; first joint a little shorter than the fourth. *Thorax* dull blackish, with a slight grey dusting; præscutum with two grey stripes and a median grey line faintly indicated. Pubescence yellowish, short and sparse. *Abdomen* uniformly blackish brown, shining, about twice as long as the thorax. *Hypopygium*: ninth tergite with a broad V-shaped terminal emargination. Side-pieces simple, nearly cylindrical, but somewhat curved, about 2·5 times as long as broad. Outer clasper without long hairs, finely pubescent at the base and on the inner side a little before the tip, which is rather suddenly narrowed but gently curved. Inner clasper broad, hairy, with deep groove for reception of outer clasper, separated from the latter down to the extreme base; tip somewhat produced inwards. Parameres bilobed; dorsal lobe conical, sharply pointed; ventral lobe broad, somewhat narrowed towards the rounded tip. Dorsal plate slightly emarginate apically. Penis much shorter than the mesosome, broad at the base, terminating in two long points. *Legs* rather long and slender, dark brown, extreme tips of all joints black. Claws with small basal tooth; empodium nearly as long as the claws. *Wings* light brown, veins and stigma darker. Sc ending distinctly beyond apex of Rs.

Tip of R_1 a little longer than r. R_{2+3} and R_2 about equal in length and nearly in a straight line ; r–m less than its own length from base of R_{4+5}. Cu_1a reaching M_{3+4} at one-fifth of discal cell, which is not quite twice as long as broad. Cu_2 straight, shorter than Cu_1a and forming an angle of 120° with it. Distance from tip of Ax to tip of An about equal to that between Cu_2 and Cu_1, and nearly three times that between Cu_2 and An. *Halteres* yellowish with black tips.

Length of body 8 mm. ; wing 10×2·6 mm.

Ceylon : Haragam, 1. vi. 1892, 1 ♂ (*Lt.-Col. Yerbury*).

2. *Eriocera stricklandi*, sp. n., ♀.

Head dull blackish grey ; sides of frontal tubercle ochreous ; pubescence blackish, short but rather dense. Frontal tubercle simple, rather large and projecting. Antennæ entirely black, fully as long as the head and thorax together ; first scapal joint about four times as long as broad. Flagellum with the three basal joints distinct, third a little longer than the second, but shorter than the first ; five joints, apparently, in the terminal portion. Palpi black ; second joint much longer than the first or third and nearly equal to the fourth. *Thorax* greyish ochreous, with a moderately long and rather dense ochreous pubescence. Præscutum with three broad slightly shining blackish-brown stripes, the side-stripes continued across the scutum. Lower half of pleuræ, also the coxæ, whitish grey. *Abdomen* dull ochreous-orange, the first four tergites and the apex of the fifth dark brown. *Ovipositor* long and almost straight, the cerci much stouter than is usual in the genus. *Legs* ochreous, tarsi rather darker ; all tibiæ with black tips ; front and middle femora rather broadly black at the tips ; hind femora black, except on the basal fifth. Claws simple, twice as long as the broad empodia. *Wings* ochreous-tinged, costal cell yellower, stigma distinct, but rather ill-defined, blackish ; veins mostly ochreous. Sc ending midway between base of R_2 and r ; tip of R_1 slightly upturned, a little longer than r ; R_2 quite four times as long as R_{2+3} ; r–m more than twice its length from base of R_{4+5} ; cell M_1 present, shorter than its petiole ; discal cell not much longer than broad ; Cu_1a at about one-third of discal cell ; Cu_2 curved, at right angles with Cu_1a at base. *Halteres* ochreous.

Length of body 30 mm. ; wing 21 × 6 mm.

Japan : (no exact data), 1909 (*T. A. G. Strickland*).

3. *Eriocera waterstoni*, sp. n., ♀.

Head blackish grey, dull, nearly bare; frontal tubercle small but distinct, simple. Scape of antennæ black, the first joint a little over twice as long as broad; flagellum missing. Palpi black; second joint swollen but elongate, much longer than the first or third, and a little longer even than the fourth. *Thorax* dull blackish grey; a whitish line on the extreme margin of the mesonotum; above this, just in front of the wing-base, a short velvet-black stripe. Upper half of the pleuræ deep black, shining except in places; lower half heavily dusted with whitish grey. *Abdomen* black, somewhat shining; ovipositor slender, reddish. *Legs*: front coxæ blackish, the others ochreous, all grey-dusted; trochanters ochreous; remainder of legs missing. *Wings* uniformly blackish. Venation like that of *E. chirothecata* (as figured by Kuntze, 1913), except that Cu_1a is hardly beyond the middle of the discal cell, and the distance between the tips of Ax and An is over twice that between An and Cu_2. *Halteres* black.

Length of body 13 mm.; wing 12 × 3·2 mm.

Macedonia: Rendino Gorge, vi. 1918 (*Capt. J. Waterston*).

The venation is very similar to that of *E. schnusei*, Kuntze; probably, as in that species, the tarsi are dark, but confirmation of this point is required.

4. *Eriocera umbripennis*, sp. n., ♀. (Pl. X. fig. 2.)

Head black, with some rather long black bristly hair; frontal tubercle rather small, triple, a single conically produced upper division, two more rounded tubercles just above base of antennæ. Antennæ black, slightly longer than the thorax; first scapal joint about three times as long as broad; flagellum with the first four joints distinct, gradually diminishing in length; terminal portion scarcely equalling the preceding three joints together. Palpi with the four joints about equal in length, each roughly four times as long as broad. *Thorax* purplish black; præscutum with five deeper black stripes, the three middle ones narrow; pubescence black, rather spare and short. *Abdomen* with the four basal segments dull orange, the rest velvet-black; valves of the ovipositor elongate, slender, reddish. *Legs*: coxæ, trochanters, and middle femora black (rest missing). *Wings* uniformly black. Sc_1 ending opposite *r*; Sc_2 opposite base of R_2; *r* more than three times its length from tip of R_1:

r–m nearly twice its length from base of R_{4+5}; cell M_1 present, a little longer than its petiole; Cu_1a just beyond middle of discal cell; Cu_2 short, curved; distance Ax–An on wing-margin not much longer than An–Cu_2, and distinctly shorter than Cu_2–Cu_1. *Halteres* black.

Length of body 21 mm.; wing 15×4·2 mm.

Penang: no further data (*H. N. Ridley*), 1 ♀.

5. *Eriocera shirakii*, sp. n., ♂.

Head velvet-black, pubescence black, rather long; frontal tubercle moderate, simple. Antennæ black, rather less than twice as long as the thorax; first scapal joint small, very little longer than broad; flagellar joints regularly diminishing in length, the fourth rather more than half as long as the first. Palpi black; first and second joints about equal in length, third considerably shorter, fourth half as long again as the second. *Thorax* velvet-black; pubescence black, long and dense; præscutum with four rather narrow, slightly shining stripes. *Abdomen* with segments 1, 6, 7, and 8 entirely velvet-black, 2–5 and 9 entirely orange. *Hypopygium*: ninth tergite emarginate. Side-pieces simple, somewhat narrowed towards the tips, nearly three times as long as broad. Outer clasper with a few long hairs towards the base, abruptly narrowed a little before the tip, which is bent inwards and hook-like. Inner clasper moderate, separated from the outer almost to the base. Parameres bilobed, dorsal lobe curved, pointed; ventral lobe larger than the dorsal, long-conical, the sharply pointed apex projecting inwards. Dorsal plate entire. Penis as long as the mesosome, straight, pointed, bare. *Legs* black, somewhat shining, moderately stout. Claws with strong basal tooth, twice as long as the empodium. *Wings* uniformly blackish, anal and axillary cells somewhat lighter. Sc ending opposite base of R_2; *r* over twice its length from tip of R_1; R_2 over twice as long as R_{2+3}; *r–m* nearly twice its length from base of R_{4+5}; cell M_1 absent; Cu_1a just before middle of discal cell; Cu_2 curved, not much shorter than Cu_1a. Distance Ax–An on wing-margin just over twice An–Cu_2. *Halteres* black.

Length of body 13 mm.; wing 12×3·8 mm.

Formosa: Koshun, 25. iv.–25. v. 1918 (*J. Sonan, K. Miyake*, and *M. Yoshino*), 1 ♂, presented to the British Museum by Dr. T. Shiraki.

It is possible that this may be the male of *E. rubriceps*, Edw.

6. *Eriocera flavicosta*, sp. n., ♀. (Pl. X. fig. 4.)

Head black, with black bristly hair; frontal tubercle small, divided into two by a transverse furrow. Antennæ with the first three flagellar joints light brown, rest black. First scapal joint above three times as long as broad; flagellum 8-jointed, the joints gradually decreasing in length. Palpi black, rather stout, first joint a little longer than the others, which are all about equal in length. *Thorax* dull black, without distinct markings; pubescence dark, moderately short and spare. *Abdomen* with segments 1, 5, 6, 7, and sides of 4 black; 2, 3, 8, middle of 4, and ovipositor orange. *Legs* ochreous-brown; coxæ, trochanters, tips of femora and tibiæ, and terminal tarsal segments black. Claws simple; empodium very short and broad. *Wings* brown, darker on the apical third; the costal and inner marginal cells yellow; a distinct white spot at the tip, including the tips of R_3 and R_{4+5}. Sc ending opposite base of R_2; *r* scarcely twice its length from tip of R_1; R_2 a little over twice as long as R_{2+3}; *r–m* below the base of R_2; Cu_1a near apex of discal cell; Cu_2 short, slightly curved; distance Ax–An on wing-margin about three times An–Cu_2. *Halteres* black.

Length of body 26 mm.; wing 18 × 5 mm.

India: Nilgiri Hills, 3000 ft., 21. viii. 1888 (*Sir G. F. Hampson*), 1 ♀.

7. *Eriocera kempi*, Brun., var. n. *longior*.
(Pl. X. fig. 5.)

Differs from *E. kempi*, Brun. (as represented by a paratype in the British Museum), as follows:—*r–m* longer, not shorter than *r*; upper of the two veins closing the discal cell half as long as the lower (in *E. kempi* paratype the upper is obliterated); Cu_1a well before, not at the tip of the discal cell; no minute clear spot in cell Cu_1; two-thirds of abdominal segments 4 and 5 orange, these segments also being longer in proportion to their breadth; a large orange spot at the base of the sixth tergite; outer claspers of hypopygium with a deeper preapical notch.

Length of body 28 mm.; wing 21 × 5 mm.

India: Mt. Hamilton, 2 ♂.

8. *Eriocera ctenophoroides*, Edw., var. n. *nigrithorax*, ♀.

Differs from *E. ctenophoroides*, Edw., as follows:—First joint of flagellum distinctly longer and more slender, scarcely any thicker than the second joint (in *E. ctenophoroides* it is distinctly thicker); thorax and last abdominal segment

velvet-black; middle segments of abdomen extremely broad, quite twice as broad as the base and considerably broader than in the type female of *E. ctenophoroides*; legs stout, but considerably less so than in the type, the femora and tibiæ being also distinctly longer.

Ceylon: Pallamadulla, 17. vi. 1892, 1 ♀ (*Lt.-Col. Yerbury*).

I referred to this specimen in describing *E. ctenophoroides* in 1911. The difference from the type is not confined, as I then thought, to the black thorax, and the specimen evidently represents a distinct variety if not species.

9. *Eriocera albonotata*, var. n. *citrocastanea*.
(Pl. X. fig. 6; text-fig. 2 f.)

Differs from the typical form as follows:—Thorax and dark parts of the abdomen dark chestnut-brown, not black; fifth abdominal segment of male longer and entirely dark; femora without black tips; hypopygium rather light brown; side-pieces longer (quite 1·5 times as long as their breadth at the base); penis longer (about 4 times instead of 2·5 times as long as its breadth at the base); preapical notch of outer clasper much less distinct.

Length of body, ♂, 23 mm.; wing, ♂, 17×4·8 mm.

Length of body, ♀, 25 mm.; wing, ♀, 19×5 mm.

Ceylon: Passara, 6. vi. 1897 (*Lt.-Col. Yerbury*), 1 ♂; Pundaluoya, v. 1889 (*E. E. Green*), 1 ♀.

10. *Eriocera robinsoni*, sp. n., ♀. (Pl. X. fig. 3.)

Head dull blackish grey, with numerous black bristles; antennæ and palpi dark brown. Frontal tubercle moderate, simple. First scapal joint more than three times as long as broad. Flagellum six-jointed, first two joints together longer than the remaining four. Palpi rather short and stout, first joint a little longer and more slender than the remaining three, which are subequal. *Thorax* dull dark brown, unmarked. *Abdomen* velvety-black, rather damaged, but apparently with shining bands at the bases of the tergites. *Legs* uniformly blackish; claws simple; empodia short and thick. *Wings* rather strongly infuscated; a large but inconspicuous pale area in the middle extending across the inner marginal and basal cells, but not quite reaching R_1 or Cu. Sc ending just beyond base of R_2; *r* about three times its length from tip of R_1; R_2 more than three times as long as R_{2+3}; four posterior cells; Cu_1a near apex of

discal cell; Cu_2 as long as Cu_1a, slightly curved; distance Ax–An on margin about twice An–Cu_2. *Halteres* black.

Length of body 14 mm.; wing 11×3·3 mm.

Siam: Bukit Besar (*H. C. Robinson* and *N. Annandale*), 1 ♀.

11. *Eriocera assamensis*, sp. n., ♀.

Head dark greyish brown, with rather long and dense black hair. Frontal tubercle moderate, simple. First scapal joint dark greyish brown, four times as long as broad; second scapal and first three flagellar joints yellow, tip of flagellum dark. Flagellum with nine joints, the last six all rather short. Palpi black, moderately long; first and fourth joints each a little longer than the second or third, second a little thicker than the others. *Thorax* velvet-black, pleuræ with a slight brown tinge. *Abdomen* velvet-black, without shining areas; second, fourth, and fifth tergites with broad whitish-grey basal bands. Ovipositor reddish, but the segment bearing it black. *Legs* yellow; coxæ, trochanters, tips of femora and tibiæ, and the greater part of the tarsi blackish. Claws simple; empodia short and broad. *Wings* blackish; base bright yellow; a broad white fascia in the middle, extending from R_1 to the hind margin. Sc_1 extending well beyond the base of R_2; Sc_2 far before the tip of Sc_1; *r* very oblique, four or five times its length from tip of R_1, its middle joint above the base of R_2; R_2 quite four times as long as R_{2+3}; *r–m* below base of R_2; four posterior cells; Cu_1a near the tip of the rather short discal cell; Cu_2 curved, shorter than Cu_1a; distance Ax–An on the margin not quite twice An–Cu_2. *Halteres* black.

Length of body 17 mm.; wing 14×4·2 mm.

Assam: Khasi Hills (purchased from *E. Heyne*), 1 ♀, taken together with typical specimens of *E. nepalensis*.

12. *Eriocera sinensis*, sp. n., ♂. (Text-fig. 2 d.)

Head velvet-black, with black hair. Frontal tubercle divided by a transverse furrow, the lower portion somewhat more prominent than the upper. Scape of antennæ black, the first joint about four times as long as broad; flagellum missing. Palpi black; first and fourth joints slightly longer than the second and third, second distinctly thicker than the others. *Thorax* velvet-black. *Abdomen* considerably shorter than the wings; velvet-black, the second, fourth, and fifth tergites with broad leaden basal bands,

somewhat more shining basally than apically; a narrow shining leaden band at the base of the third tergite. *Hypopygium*: side-pieces simple, about twice as long as their greatest breadth. Outer claspers with small but deep preapical notch. Middle third of ninth tergite prominent, with median emargination. Parameres rather broad, somewhat pointed, dorsal lobe represented only by a small backwardly projecting tooth. Penis, if straight, would be almost as long as the side-piece, but is bent downwards and backwards about the middle. *Legs* black. Claws with basal tooth; empodia about half as long as the claws. *Wings* black, bright yellow at the base; anal and axillary cells lighter; a white median fascia of almost even width extending from R_1 almost to the hind margin. Sc_1 ending immediately before base of R_2; Sc_2 scarcely beyond base of R_{2+3}; venation otherwise almost the same as in *E. assamensis*. *Halteres* black.

Length of body 12 mm.; wing 12×3·8 mm.

W. China: Golden Buddha Mt., N. of Changking, Sze-Chuen Province, 5000 ft., 15. viii. 1907 (*W. A. Maw*), 1 ♂.

Evidently closely allied to *E. nepalensis*, but certainly distinct. The hypopygium of *E. nepalensis* differs from that of *E. sinensis* as follows:—the ninth tergite is not prominent in its middle third; the preapical noteh on the outer clasper is less marked; the side-piece is somewhat shorter and stouter; and the penis is shorter and more pointed.

13. *Eriocera chrysomela*, sp. n.
(Pl. X. fig. 7; text-fig. 2 a.)

Head velvet-black, with a pale grey central longitudinal line, and with black hair. Frontal tubercle divided into three parts, the upper portion rounded, only very slightly prominent, the lower portion produced into two conspicuous tubercles. Antennæ black; first scapal joint about three times as long as broad; first flagellar joint half as long again as the second, which is half as long again as the third; terminal portion about as long as the first joint, without definite jointing in the male, but with six rather indistinct joints in the female. Palpi black, moderately long; fourth joint almost as long as the second and third together; first not quite as long as the fourth; second somewhat thicker than the others. *Thorax* uniform velvet-black or very dark brown; pubescence sparse and not very long. *Abdomen* velvet-black; basal halves of tergites 2–5 shining blackish; beyond the shining area is a rather narrow transverse leaden-grey band on each of the segments

2–5; hypopygium, ovipositor, and the segment bearing the ovipositor orange. *Hypopygium*: ninth tergite with the central portion strongly produced, but emarginate in the middle. Side-piece less than twice as long as its basal diameter, much narrower apically; at the base on the ventral side with a rounded prominence bearing a row of about 15–20 short spines. Outer clasper bare, with a deep excavation on the outer side near the base, preapical notch small. Inner clasper rather narrow, incompletely separated from the outer. Parameres rather long, straight, with rounded tips, no basal tooth. Penis (if straightened) would be a little longer than the side-pieces, but is bent downwards and backwards about its middle; both halves are strongly curved; the outer (ventral) half bears numerous short bristly hairs, which are most dense at the tip; on the outer side of the bend is a deep groove, tip not much thinner than base. *Legs* long, slender, black; claws of the male with basal tooth, not much longer than the narrow empodium; of the female simple, empodium short and broad. *Wings* blackish at the extreme base, beyond which rather more than half of the wing is yellow; anal and axillary cells lighter. At the outer edge of the yellow area is a clear whitish spot extending across the basal cells but not reaching Rs or Cu. The apical part of the wing, from the tip of Sc to the tip of Ax, is blackish brown, except for the tip, which is rather broadly pure white. Sc ending opposite *r*, which is about three times its length from the tip of R_1, and not quite its own length from the base of R_2; R_2 more than three times as long as R_{2+3}; *r–m* below base of R_2; cell M_1 present, more than twice as long as its stalk; Cu_1a close to apex of discal cell; Cu_2 slightly curved. *Halteres* black.

Length of body, ♂, 13 mm.; wing, ♂, 12 × 3·7 mm.
Length of body, ♀, 21 mm.; wing, ♀, 15 × 5 mm.
Hong Kong (*J. C. Bowring*, 1861), 1 ♂, 1 ♀.

14. *Eriocera plumbolutea*, sp. n., ♂. (Text-fig. 2 c.)

Head velvet-black, with long and dense black hair. Frontal tubercle triple, the pair of tubercles above the antennæ rather small, but slightly larger than the unpaired and more rounded dorsal tubercle. Antennæ with the scape blackish, first joint about three times as long as broad; first three flagellar joints yellow (remainder missing). Palpi black (damaged). *Thorax* entirely velvet-black, except for the prothoracic lobes, which are reddish and rather more prominent than usual. Sides of mesonotum with long and

dense black hair; præscutum also with long black hair along the furrows. *Abdomen*: segments 1 and 6–8 entirely velvet-black, 2–5 with yellow ground-colour, dusted over with grey, more shining basally, apical fifth of each velvet-black. *Hypopygium* orange-yellow. Ninth tergite with its middle portion strongly produced, emarginate in the middle, rather densely hairy. Side-pieces about twice as long as their breadth at the base; an irregular row of about 20 short blunt spines at the base beneath, not situated on a definite prominence. Outer clasper bare, slightly thickest in the middle, without distinct excavation on outer side near base; preapical notch slight. Inner clasper broad, incompletely separated from the outer. Parameres with a trace of a basal tooth; long, nearly straight, with rounded tips. Penis with a thick, nearly straight basal portion which is nearly as long as the side-piece, then bent downwards and backwards for about half the length of the basal portion, then forwards again as a slender bare filament which is nearly as long as the basal portion. *Legs*: coxæ and trochanters black; femora yellow with black tips; tibiæ brownish with black tips; tarsi blackish; claws with small basal tooth; empodia short. *Wings* with dark brown ground-colour; yellow at the base and in the whole of the costal and subcostal cells; a large nearly square white spot near the tips of the basal cells, extending from Rs to Cu; a small white spot in the inner marginal cell just above the fork of Rs; a very small white spot on the extreme tip, just including tips of R_3 and R_{4+5}. Sc ending opposite *r*; Sc_2 much before tip of Sc_1; *r* rather long, vertical, twice its length before tip of R_1; R_2 nearly four times as long as R_{2+3}; cell M_1 present, more than twice as long as its stalk; Cu_1a almost at tip of discal cell; Cu_2 nearly as long as Cu_1a, slightly curved. *Halteres* black, tip greyish.

Length of body 14 mm.; wing 12·5 × 4 mm.

Assam: Khasi Hills (purchased from *E. Heyne*), 1 ♂.

15. *Eriocera brunettii*, sp. n., ♂. (Text-fig. 2 b.)

Head very dark ash-grey, pubescence moderate. Frontal tubercle triple, the unpaired dorsal portion very slight indeed. Antennæ black; first scapal joint about three times as long as broad; flagellum with five joints, each a little shorter than the preceding. Palpi black; first and fourth joints each about as long as the second and third together; second a little thicker than the others. *Thorax* dull orange dorsally, nearly bare; præscutum and scutum

more reddish-tinged, scutellum and postnotum more yellowish-tinged. Pleuræ dark grey, passing to orange above. *Abdomen* entirely black, mostly shining; fifth and sixth segments only with narrow velvet-black apical borders (possibly the shining appearance of the basal segments may not be natural). *Hypopygium* resembling that of *E. plumbolutea*, but the short spines on the bases of the side-pieces are borne on an ear-shaped process; the outer clasper is thickest near the base, where it is finely pubescent; the inner clasper is narrower; and the penis, though at least as long, is rather differently convoluted. *Legs* black; claws with small basal tooth; empodia short. *Wings* resembling those of *E. plumbolutea*, but base and costal region dark; the large central white spot less square and not quite reaching Cu; apical white mark long, narrow, and crescent-shaped, extending from before the tip of R_2 to the tip of M_1; Cu_1a not much beyond middle of discal cell. *Halteres* black, base of stem pale.

Length of body 11 mm.; wing 10 × 3·2 mm.

Assam: Tura, Garo Hills, 1400 ft., 17.x.1917 (*Mrs. S. Kemp*), 1 ♂.

The specimen was sent by Brunetti as his *gravelyi*, from which it differs in the orange scutellum and postnotum, the absence (natural?) of velvet-black bands on most of the abdominal segments, the shape of the apical wing-spot, and the position of Cu_1a. A female of *E. gravelyi* in the British Museum from Sikkim (*J. G. Pilcher*) agrees exactly with one sent by Brunetti from the Darjiling district. It seems most probable therefore that Brunetti has confused two distinct species under the name *gravelyi*.

16. *Eriocera trimaculata*, sp. n., ♀. (Pl. X. fig. 8.)

Head velvet-black, pubescence black, rather long and dense. Frontal tubercle triple, each division very small and rounded. Scape of antennæ black, flagellum yellowish, except towards the tip. First scapal joint nearly four times as long as broad. Flagellum with seven joints, the first about as long as the next two together, the last three equal in length. Palpi black, first joint scarcely as long as the second, which is much thickened, fourth as long as the second and third together. *Thorax* entirely velvet-black, except for the scutellum, which is reddish orange; pubescence rather long, black. *Abdomen* velvet-black, without shining bands, but with large pearly-white lateral basal spots on tergites 4–6. *Legs* short and stout, with long black pubescence; dark brown in colour, the coxæ and the tips of the other joints

black ; claws simple ; empodia short. *Wings* blackish, anal and axillary cells lighter; a large central white spot extending from Rs to Cu ; a second rather large white spot extending from R_1 to R_{2+3} ; a third at the wing-tip, reaching from the tip of R_2 to just beyond the tip of R_{4+5}. Sc_1 ending just before *r* ; Sc_2 opposite fork of Rs ; *r* somewhat oblique, three times its length before tip of R_1 ; R_2 quite four times as long as R_{2+3} ; *r–m* slightly beyond base of R_2, also slightly beyond middle of upper margin of discal cell ; cell M_1 present, with extremely short stalk ; Cu_1a near apex of lower margin of discal cell ; basal section of M_3 very oblique ; Cu_2 somewhat curved, as long as Cu_1a.

Length of body 20 mm.; wing 11·5 × 4·5 mm.

Assam : Khasi Hills (purchased from *E. Heyne*), 1 ♀.

17. *Eriocera borneana*, sp. n., ♀? (Pl. X. fig. 12.)

Head blackish grey, with moderately long black pubescence. Frontal tubercle triple, but only very slightly prominent. Antennæ and palpi black (tips of both missing in type). *Thorax* almost uniformly red ; pleuræ only a little darker ; pubescence normal, pale. *Abdomen* missing in the type. *Legs* rather short, dark brown, tarsi darker ; claws simple ; empodium short and narrow. *Wings* dark brown ; a white fascia in the middle, extending from R_1 to Cu (at which it ends abruptly) and just touching the fork of Rs ; another white spot immediately before the apex, not touching the front margin, but reaching the hind margin between R_{4+5} and M_{1+2}. Sc_1 ending opposite base of R_2; Sc_2 near tip of Sc_1 ; *r* vertical, about three times its length from tip of R_1 ; R_2 nearly four times as long as R_{2+3} ; *r–m* below base of R_2 ; basal section of M_{1+2} (*i. e.*, inner margin of discal cell) nearly vertical ; a trace of vein M_1 present (more marked in the wing figured than in the other) ; Cu_1a at about two-thirds of discal cell ; Cu_2 slightly curved, longer than Cu_1a. *Halteres* black.

Size of wing 9 × 3 mm.

Borneo : Kuching, Sarawak, 27. iv. 1900 (*J. Hewitt*), 1 ♀ (?). A second specimen, almost certainly belonging to the same species, is in the Cambridge Museum from Borneo (Kuching ?), 20.x.1901 (*R. Shelford*). In this specimen the first three abdominal segments and the ovipositor are yellow, the remainder of the abdomen dark. The wing differs from the type in having no trace of a pale subapical spot, and no trace of vein M_1. The size of the subapical wing-spot is probably variable, since in Walker's male type of *E. infixa*

it is a mere dot, while in three females of the same species it is much larger (in all three it touches the front but not the hind margin of the wing).

Remarks on various Species.

1. *E. ornata* (End.), described from Sumatra, is represented in the British Museum by two males—one from Port Dixon, Malay Peninsula, 19. ii. 1908 (*G. Meade-Waldo*), and one from Kuching, Sarawak, 21. i. 1902 (*J. Hewitt*). It evidently occupies an isolated position in the genus, but there is no subgeneric name available for it, since Enderlein designated *A. verticale* as the type-species of *Androclosma*. Apart from the peculiarities of venation, the parameres of the ædœagus (text-fig. 2 i) have a unique structure; the free portion is simple, elongate, blunt-ended, and more than half as long as the side-piece. The outer clasper and the penis are constructed somewhat as in the *verticalis* group, and may perhaps indicate a connection therewith. The length of Rs is variable, being over three times as long as R in the Kuching specimen, rather shorter in the one from Port Dixon, and only twice as long as R in Enderlein's figure.

Fig. 1.

Male genital claspers of species of *Eriocera*, × 40.

a, *E. brunetti*, sp. n.; b, *E. verticalis*, Wied.; c, *E. rubrescens* (Walk.); d, *E. luteipennis* (Edw.).

2. *The Seychelles Species.*—The four species described from the Seychelles are evidently quite closely allied, as is shown by the structure of the hypopygium of three of them (*E. obscuripennis, E. fuscinervis,* and *E. luteipennis*) (text-figs. 1 d, 2 n, 2 o). In all these the outer clasper is regularly narrowed towards the tip, which is, however, bent inwards almost at right angles to the shaft; the parameres are bifid, the outer lobe being straight and pointed, the inner with a rounded tip; the penis is small and not distinctly separated

from the mesosome. Apart from this the species resemble one another in build, coloration, yellow scape of the antennæ, small size of frontal tubercle, short, more or less convex axillary vein, rather short Sc, short R_2, and position of *r–m* cross-vein. The apparently fundamental difference in the number of posterior cells (3 or 4) is bridged in an interesting way. A re-examination of the three specimens of *A. luteipennis* in the British Museum shows that one of them has three posterior cells (as figured by me in 1912) ; one has very distinctly four posterior cells and a closed discal cell ; while the third has a short disconnected piece of vein M_3 present. I therefore consider the removal of *E. luteipennis* and *E. ferruginea* from *Hexatoma* to be entirely justified. The Seychelles group is a very distinct one when Old-World forms alone are considered, but the South-American *Penthoptera sanctæ-marthæ*, Alex., shows certain resemblances.

3. *The* crystalloptera *Group*.—The four Ceylon species with crystalline wings described by Osten-Sacken form another distinct group, with a number of characters in common, as indicated in the key. Three of these are represented in the British Museum, but only one of them (*E. crystalloptera*) in the male sex. The hypopygium of this species, like that of *Hexatoma*, has bilobed parameres (text-fig. 2 k), the upper lobe being bent about the middle, and a small arrowhead-like penis, but the outer clasper has the subapical notch well-marked.

4. *E. lunata*, Westw.—This is another isolated species with a striking venational peculiarity in the extremely broad upper basal cell (a point which is not sufficiently brought out by Westwood's figure) and with a very distinctive type of wing-marking. The white tip to the veins R_1 and R_2, also *r*, may indicate a connection with *E. ornata* ; if that is so, the straight tip of Cu_1 could be regarded as linking *E. ornata* with the *verticalis* group. Additional characters common to *E. ornata* and *E. lunata*, and found only in these two species, are the unusual breadth of the upper basal cell and the parallelism of the basal part of Rs with R_1 ; neither of these points is at all indicated in *E. verticalis*. The hypopygium of Westwood's type (the only example known) is unfortunately now damaged, but Westwood figures a very peculiar structure of the claspers, and the parameres (unless broken off) are not elongate as in *E. ornata*.

5. *E. pusilla*, Alex.—In the very short, strongly upturned tip of R_1, as well as in the structure of the hypopygium and ovipositor, this species shows a greater resemblance to *Hexatoma* than to *Eriocera*, and should in my opinion be placed there. It is particularly interesting as connecting *Hexatoma*

with the *verticalis* group of *Eriocera*, and as a further instance showing the inadvisability of using the character of the number of branches of the media for generic classification in the Tipulidæ.

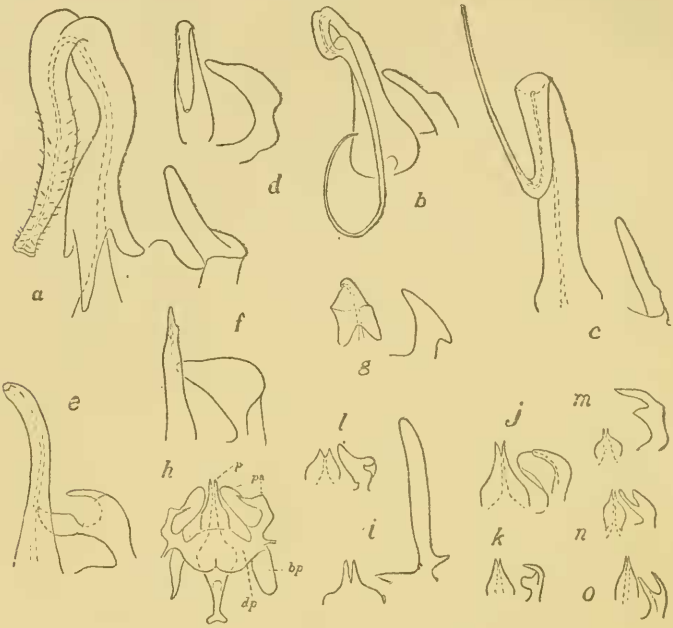
6. *The* verticalis *Group.*—This, as I interpret it, includes the thirteen species under section 12 in the key. Apart from the general similarity in coloration and venation already noted in the key, there are certain hypopygial characters common to many, if not all, of the species. The organ has been examined in six (*fusca, nigrina, nyasicola, tumidiscapa, yerburyi*, and *verticalis*), all of which show the following common features: outer clasper (text-fig. 1 b) rather gently narrowed towards the curved-down tip, no preapical notch; inner clasper broad; side-pieces simple at the base, somewhat curved; parameres bilobed, lobes about equal in length, upper lobe pointed, lower lobe very broad, with rounded tip, placed nearly in a vertical plane; penis very short, arrow-head-shaped (text-fig. 2 j). If it should be desired to accord this group subgeneric rank, the names *Androclosma* and *Globericera* are available. The South-American species of true *Eriocera* (including the type of the genus, *E. nigra*, Macq.) approach this group in several respects—for example, in the comparatively short vein R_2 and the straight, strongly down-bent Cu_2. However, the hypopygium of a few species which I have examined does not seem to show any very close affinity between the two groups.

7. *The* rubrescens *Group.*—Included under this heading are the seven species from *stricklandi* to *angustipennis* in the key, under the number 27, and also *longifurca*, Alex., and *tripunctipennis*, Brun. Although there are among these some with five posterior cells and some with four, it is fairly certain that they are all somewhat closely related, except perhaps *E. stricklandi*, which differs from the others in its much larger frontal tubercle. Of the remaining species, four are represented in the British Museum by males, and the hypopygia of these have been examined. *E. rufiventris*, *E. pœnulata* (text-fig. 2 m), and *E. pyrrhochroma* are very similar and have rather small bilobed parameres, the upper lobes smaller than the lower, both lobes projecting inwards; the penis is small and rounded; the outer clasper is rather abruptly narrowed a little before the tip, but not so much so as in many other species. *E. rubrescens* (text-figs. 1 c, 2 l) is somewhat different: the outer clasper with the tip more hook-like; parameres broad, rounded, not bilobed; penis very short, but pointed. *E. stricklandi* (known so far only from the female) would seem to be closely related to the N.-American *E. spinosa*, differing chiefly in the colour of

the abdomen and the larger size. Since *E. spinosa* is the type of the subgenus *Arrhenica*, O.-S., this name will be available for the group.

The preceding groups, though diverse in many respects,

Fig. 2.



Details of ædœagus of Old-World species of *Eriocera*. All ×40. Except in **h** (*E. schnusei*, Kuntze) only the penis and one paramere are shown.

a, *E. chrysomela*, sp. n.; **b**, *E. brunettii*, sp. n.; **c**, *E. plumbolutea*, sp. n.; **d**, *E. sinensis*, sp. n.; **e**, *E. lygropis*, Alex.; **f**, *E. kempi*, Brun., var. n. *longior*; **g**, *E. lunigera*, Walk.; **i**, *E. ornata* (End.); **j**, *E. verticalis*, Wied.; **k**, *E. crystalloptera*, O.-S.; **l**, *E. rubrescens*, Walk.; **m**, *E. pœnulata*, End.; **n**, *E. obscuripennis*, Edw.; **o**, *E. luteipennis* (Edw.).

In fig. **h** the whole ædœagus of *E. schnusei*, Kuntze, is shown in dorsal view: *p* = penis; *pa* = paramere; *bp* = basal plate; *dp* = dorsal plate.

have one character in common, the shortness of the penis, which is produced into two little points at the tip. In the remaining species the structural details are somewhat less varied, especially the venation, which shows few tangible modifications; the hypopygial structure is also fairly uniform, there being nearly always a pronounced preapical

notch on the outer clasper, due to the abrupt narrowing of the shaft a little before the tip; the side-pieces are shorter than in the other groups, and the penis is nearly always long and pointed, often curved or hook-like, its tip scarcely ever produced into two points. The tip of R_1 is always considerably longer than r; Cu_1a generally nearer the apex than the base of the discal cell; R_2 always much longer than R_{2+3}; Cu_2 generally quite short and more or less curved. Here, again, there are species with four or with five posterior cells, but the species in each of these categories are not all closely related. On the whole, the classification by wing-markings and by the presence or absence of leaden-coloured bands on the abdomen seems to give the best expression of the natural affinities of the species. The following groups may be recognised :—

8. *The* chirothecata *Group*, including the three South-European species with five posterior cells and perhaps also *unicolor*, Meij., and *obscura*, Big. In this group the only species known to me in the male sex is *E. schnusei* (text-fig. 2 h). This has a short penis and parameres of similar structure to those of the *verticalis* group; in these respects, as well as in its coloration, it seems to connect the *verticalis* group with the *dichroa* group. On the other hand, the elongate second palpal joint of *E. schnusei* and *E. waterstoni* suggests a connection with the *rubrescens* group, through *E. stricklandi*. I am not acquainted with the type-species of *Penthoptera* (*chirothecata*, Scop.) or *Physecrania* (*obscura*, Big.), but from the published figures both would seem to belong to the same group as *schnusei*; if so, these generic names will be synonymous. This group may perhaps be regarded as representing the ancestral type of the genus, and as having given rise on the one hand to the *verticalis* group and on the other to the *dichroa* group.

9. *The* dichroa *Group* may be regarded as including all the species with blackish unmarked wings, and an entirely dull, partly orange abdomen. In a number of species, but not all, the first antennal joint is short. In the venation, R_1 is perfectly straight, its terminal section much longer than r. The outer clasper has a well-marked preapical notch; the parameres are bilobed, both lobes pointing inwards, but the ventral lobe straighter and longer than the dorsal; the penis rather long and pointed, but straight. (This applies to *scutellata* and *shirakii*; but a male of *semilimpida* examined appeared to have no penis; it may have been broken off.) *E. maculiventris*, Brun., is given as a synonym of *E. semilimpida*, Brun., on the authority of Brunetti (in letter),

though the descriptions do not quite agree, especially as regards the thorax.

Closely allied to the *dichroa* group, and certainly not separable from it subgenerically, are : (*a*) the *bicolor* group, with similar claspers, side-pieces, and parameres to those of the *dichroa* group, but with the penis somewhat longer and more curved ; (*b*) the *morosa* group, with hypopygium similar to that of the *bicolor* group, but with quite different coloration ; (*c*) the *albonotata* group, with three apical wing-spots, deep preapical notch on outer clasper, parameres almost simple, the dorsal lobe represented by a small backwardly-projecting tooth, penis straight ; (*d*) the *albipunctata* group, with one apical wing-spot, side-pieces swollen at the base beneath, parameres broader than in the *albonotata* group (text-fig. 2 f), penis more or less curved ; (*e*) the *infixa* group (*E. infixa, E. borneana,* and probably some other species with dull abdomen and ornate wings), with hypopygium resembling that of the *albonotata* group, but preapical notch of outer clasper less well-marked.

I do not know *E. javensis* (Dol.), but if, as seems likely, it is nearly related to *E. infixa*, the name *Oligomera* could be applied to the whole of this group, if it could be satisfactorily distinguished from the *chirothecata* group, which hardly seems possible.

10. *E. lunigera* (Walk.) has several peculiarities in its hypopygium (text-fig. 2 g). The side-pieces have a small rounded basal lobe studded with small blunt black spines; the outer clasper almost regularly narrowed to the tip, which is scarcely bent; the penis is very short and broad, but somewhat curved ; the parameres with strong backwardly projecting basal tooth. Walker's type of *optabilis* has now nothing left but the head and thorax; these, however, agree exactly with *E. lunigera*, so that the two names most probably apply to the same species.

11. *The* plumbicincta *Group,* including the seven species under heading 88 in the key. All these are evidently closely allied, and, apart from the similarity of wing-markings (which is obscured but not obliterated in *E. chrysomela* by the development of yellow colour on the basal half) and in the abdominal banding, they agree in the presence and somewhat unusual length of cell M_1. The hypopygium is remarkable for the great length of the penis (see descriptions of the new species, and text-figs. 2 a, 2 b, 2 c) ; the outer claspers (text-fig. 1 a) have the preapical notch unusually small, the tip scarcely bent; the side-pieces of all the species

examined have more or less distinct basal lobes beset with spines, somewhat as in *E. lunigera*.

12. *The* nepalensis *Group*, including the eight species from *decorata* to *hilpa* in the key, is evidently nearly allied to the *plumbicincta* group, in spite of possessing only four posterior cells. The type of abdominal marking is very similar, the grey bands in the midde of tergites 2–5, which are so conspicuous in this group, being distinctly traceable in some of the members of the *plumbicincta* group. The relationship is also indicated in the hypopygium, the penis being rather long and hooked (text-fig. 2 d), though not nearly so long as in the *plumbicincta* group. The side-pieces, however, have no trace of spiny basal lobes. *E. sauteriana* and *E. leucotela* have a hypopygium similar to that of *E. nepalensis*. The name *Pterocosmus* would be available for this group, the type-species being *P. velutinus* (= *E. nepalensis*). Both Westwood's and Walker's types are in fairly good condition in the Oxford and British Museums respectively.

The *nepalensis* group seems to be connected with the *dichroa* group through the *morosa* group.

EXPLANATION OF PLATE X. Figs. 1–12.

Wings of Old-World species of *Eriocera*.

Fig. 1. *Eriocera fusca*, Edw. × 3.
Fig. 2. *E. umbripennis*, sp. n. × 2·5.
Fig. 3. *E. robinsoni*, sp. n. × 2·5.
Fig. 4. *E. flavicosta*, sp. n. × 2·5.
Fig. 5. *E. kempi*, Brun., var. n. *longior*. × 2·5.
Fig. 6. *E. albonotata*, Lw., var. n. *citrocastanea*. × 2·5.
Fig. 7. *E. chrysomela*, sp. n. × 3.
Fig. 8. *E. trimaculata*, sp. n. × 3.
Fig. 9. *E. combinata*, Walk. × 3.
Fig. 10. *E. leucotela*, Walk. × 3.
Fig. 11. *E. infixa*, Walk. × 3.
Fig. 12. *E. borneana*, sp. n. × 3.

IV.—*New and little-known* Tipulidæ, *chiefly from Formosa*.—Part II. By F. W. Edwards.

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[Plate X. figs. 13–19.]

This paper is a continuation of one published by the writer under the above title in 1916 (Ann. & Mag. Nat. Hist. (8) xviii. pp. 245–269, pl. xii.), and deals chiefly with a further consignment of crane-flies received from Dr. T. Shiraki,